

IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)  
Advancements in Astrobiology and Space Exploration (6)

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MAUNA LOA LAVA TUBE MICROBES: UNVEILING LIFE-DETECTION STRATEGIES FOR  
MARTIAN EXPLORATION**Abstract**

Because Mars had a geology similar to Earth's when its lava tubes were being formed, there is potential for life to exist below its surface, perhaps as extremophiles. This paper aims to explore a study of an analog astronaut mission where microbial samples are collected by hand during EVAs in a Mauna Loa lava tube to map out and optimize collection procedures. The mission will partner with the HI-SEAS Mars and Moon Simulation Analog research station so that researchers can better understand factors that enhance microbial survival in these extreme environments, which will support developing upcoming Martian life detection strategies.

The plan is to conduct genome sequencing to characterize the microbial composition and functional potential, identify diverse extremophiles, and explore how these microorganisms thrive and partition themselves across the lava tube.

State-of-the-art bioinformatic tools will be employed to assemble high-quality metagenome-assembled genomes, which may lead to further understanding of thermophiles. This comprehensive approach will shed light on lava tube microbial ecology and guide the development of practical life detection methods for Mars.

This paper may help bridge the gap between Earth-based research and potential Martian habitats by simulating a Mars analog environment within HI-SEAS. Our findings will enhance our understanding of extraterrestrial life's potential and inform future Martian exploration efforts.